NATIONAL WATER QUALITY ASSESSMENT PROGRAM: ANALYSIS OF AVAILABLE INFORMATION ON PESTICIDES FOR THE APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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INTRODUCTION

The Apalachicola-Chattahoochee-Flint (ACF) River basin was among the first 20 study basins in which studies were initiated in 1991 as part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. A major emphasis of the these studies will be to examine the occurrence and distribution of nutrients, suspended sediment, and pesticides in surface and ground water, solid-phase material, and aquatic biota in the basin. Contamination of the water resources by pesticides is a major water-quality concern nationally, and the occurrence and distribution of pesticides are a substantial component of the ACF NAWQA study. Existing data and information on pesticide use have been compiled to identify the dominant pesticides used within the ACF River basin and to estimate the amounts used. This paper, which is based on available pesticide data, briefly describes the occurrence and distribution of pesticides in the ACF River basin.

Pesticide-use and land-use data were compiled from a variety of Federal and State data bases, and from local sources, including personnel with the U.S. Department of Agriculture Soil Conservation Service and Agricultural Research Service, and the Georgia Cooperative Extension Service. These data were used to estimate the county- and basin-wide acreages in agricultural, silvicultural, urban, and suburban land-use, where pesticide use is greatest. Pesticide data also were compiled from surveys taken in lawn and garden stores and lawn-care companies, and from a publication of the National Gardening Association (1992). Available data on pesticide concentration in surface and ground water, aquatic biota, and on bottom sediments were obtained from the U.S. Environmental Protection Agency (EPA) Storage and Retrieval System (STORET), and the U.S. Geological Survey (USGS) National Water Information System (NWIS) data bases.

AGRICULTURAL PESTICIDES

Pesticides are used extensively to control weeds, insects, and other pests on farmlands. About 33 percent of the ACF River basin is in farmland, of which about 10 percent is in harvested cropland (U.S. Bureau of the Census, 1989a,b,c). In Miller, Terrell, Seminole, Mitchell, Crisp, Calhoun, Dooly, and Turner Counties in southwestern Georgia, more than 60 percent of the land is in farms. The dominant crops harvested in the ACF River basin in 1990 were peanuts, corn, wheat, hay, soybeans, and cotton. Harvested acreages of these crops ranged from 505,000 acres (peanuts) to 144,000 acres (cotton) (Alabama, Florida, and Georgia Agricultural Statistics Service, 1990). Pesticides were used extensively on crops in Seminole, Dooly, Crisp, Calhoun, Mitchell, and Miller Counties, Georgia. The acreages treated in these counties ranged from 405 acres per square mile (Seminole County) to 295 acres per square mile (Miller County). Pesticides are used most intensely from March 1 to October 1 in the basin. In the Georgia part (73 percent) of the ACF River basin, bentazon, paraquat, 2,4-DB, methanearsonates (MSMA/DSMA), alachlor, and pendimethalin were the pesticides used most extensively (307,000 to 204,000 acres); and alachlor, MSMA/DSMA, fluometuron, atrazine, metolachlor, and bentazon were the pesticides applied in the greatest quantities (506,000 to 185,000 pounds of active ingredient) (Monks and Brown, 1991).

SILVICULTURAL PESTICIDES

Pesticides also are used in forested areas within the ACF River Basin that are managed for silviculture. About 64 percent of the ACF River basin is forested, according to data for 1987-90 compiled by the U.S. Forest Service (Brown, 1987; Thompson, 1989; and Vissage and Miller, 1991). The most densely forested counties, in descending order, are Quitman County, Ga., Liberty and Franklin Counties, Fla., and Stewart and Lumpkin Counties, Ga. where the forested acreage ranges from 600 to 550 acres per square mile. About 25 percent of the forested land (16 percent of the basin) is owned by the forest industry (silviculture). In units of acres per square mile of county, the most significant silvicultural counties in the basin, in descending order, are Franklin County, Fla., Stewart County, Ga., and Gulf, Calhoun, and Bay Counties, Fla.

In silviculture, pesticides are used mainly during site preparation after clear-cutting, and during the first few years of forest growth. Site preparation occurs about once every 25 years in a pine plantation. The herbicides imazapyr, dicamba, 2,4-D, 2,4-DP, glyphosate, sulfometuron, hexazinone, triclopyr, and picloram are commonly used during site preparation (University of Georgia, 1991). These herbicides, and atrazine and sethoxydim, are used to control weeds in young pine stands. Diseases in pine stands are controlled by dimethoate, malathion, acephate, carbaryl, lindane, chlorothalonil, and chlorpyrifos. Depending on individual site characteristics, run-off and erosion may be potentially serious during the period between clear-cutting and the establishment of sufficient forest growth to stabilize the land surface. This also is the time when pesticide use is the heaviest and water resources may be most vulnerable to contamination.

URBAN AND SUBURBAN PESTICIDES

In urban and suburban areas, which constitute about four percent of the ACF River basin, pesticides are used on turf and lawns and along roadsides to control weeds, insects, and other pests. An estimated 63 percent of all southern U.S. households participated in do-it-yourself lawn-care in 1991 (The National Garden Association, 1992). Homeowners mainly use glyphosate, sulfometuron methyl, benefin (benfluralin), atrazine, bensulide, acifluorfen, 2,4-D, 2,4-DP, and dicamba for weed control. An estimated that 9 to 15 percent of southern households use professional lawn-care services (The National Garden Association, 1992; Research Triangle Institute, 1992). The herbicides most commonly used by the lawn-care industry are combinations of 2,4-D, mecoprop (MCPP), dicamba, 2,4-DP, and MCPA, or the phenoxy herbicides. The main herbicides used by local governments are glyphosate, sulfometuron methyl, MSMA, 2,4-D, and chlorsulfuron (McCarthy, 1992).

GENERAL-USE PESTICIDES

The use of several pesticides throughout the ACF River basin could be considered ubiquitous. These pesticides include chlorpyrifos, diazinon, malathion, parathion, acephate, carbaryl, dimethoate, aldicarb, and lindane, which are used to treat pests (other than weeds) in agricultural, silvicultural, urban, and suburban areas. Fenamiphos, chlorothalonil, methomyl, and phorate also are used in agricultural areas. These pesticides are used only when needed, and the amount used is difficult to estimate.

OCCURRENCE AND DISTRIBUTION OF PESTICIDES

STORET and NWIS data bases contain nearly 20,000 analyses of pesticides in surface water, ground water, solid-phase material, and aquatic biota for the ACF River basin. Ground water analyses accounted for 48.5 percent of the analyses, solid-phase material, 24.1 percent, surface water, 15.9 percent, and aquatic biota, 11.5 percent. Pesticide concentrations were above minimum detection limits in 4.8 percent of the samples analyzed; 1.9 percent in solid phase material, 1.8 percent in aquatic biota, 1 percent in surface water, and 0.1 percent in ground water. Most of the pesticides that have been detected in concentrations above minimum detection limits are environmentally persistent pesticides that have been banned in the U.S. Most of the samples for which analyses of pesticides are available were collected at least five years ago.

The most commonly detected pesticides were compounds composing the chlordane technical mixture and their metabolites; DDT and its metabolites; and dieldrin, phenoxy herbicides, pentachlorophenol, and lindane. Most of these pesticides are hydrophobic, which explains the higher number of detections in solid-phase material and aquatic biota than in water. Pesticides were detected in the solid-phase material and aquatic biota at various locations along the mainstems of the Apalachicola, Chattahoochee, and Flint Rivers. Of the pesticides detected in surface water, most were detected in the Atlanta metropolitan area. Pesticide detections in the Atlanta metropolitan area could reflect the amount of pesticides applied by homeowners, home pest-control companies, local governments, and the lawn-care industry. However, the distribution and types of pesticides detected could be more a function of the frequency, location, and types of analysis requested than an indication of what is actually present in the ACF River basin.

IMPLICATIONS FOR FUTURE STUDY

A part of the ACF River basin NAWQA study plan is to implement a spatially and temporally well-distributed sampling scheme and to analyze the samples for a more complete suite of pesticides. This will allow the occurrences of pesticides to be related to the types of media, the land uses, and the time of application. In addition, the relative persistence of some of the newer pesticides can be determined. Methods for testing and studies of the persistence of paraquat, 2,4-DB, methanearsonate, glyphosate, MCPP, and chlorothalonil need to be evaluated because these pesticides are used heavily in the ACF River basin, but are not currently proposed for analysis by the National Water Quality Assessment Program.

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